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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/643,556	08/18/2003	Jesse Dennis Wolfe	IL-11072	4907

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EXAMINER	
MCDONALD, RODNEY GLENN	
ART UNIT	**PAPER NUMBER**
1753	

DATE MAILED: 10/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/643,556	Applicant(s) WOLFE ET AL.	
	Examiner Rodney G. McDonald	Art Unit 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 August 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9,11,13-21 and 23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9,11,13-21 and 23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 2, 4, 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paranjpe et al. (U.S. Pat. 6,572,744) in view of Sellers (U.S. Pat. 5,810,982) and Xiong et al. (U.S. Pat. 6,537,428).

Regarding claim 1, Paranjpe et al. teach an apparatus for reactive magnetron sputtering including a vacuum chamber for low pressure sputtering. At least a pulsed DC power source applying a power to a target that is sputtered. An inert has and a reactive gas can be submitted to the chamber. To improve the quality of the thin film the target should be located at a great distance from the substrate which is known as a

long-throw sputtering. (Column 1 lines 15-35, lines 47-50; Column 4 lines 65-68) The pressure can be 2 mTorr or below thus meeting the mean free path requirement. (Column 6 lines 43-56; Column 6 lines 63-66)

Regarding claim 4, Paranjpe et al. teach that the long throw distance can be greater than about 15 inches (i.e. 15 inches to 18 inches). (Column 6 line 49)

Regarding claim 7, Paranjpe et al. the long throw distance is a function of the width/area of the substrate to be coated because it requires the incident angle to be 30 degrees. (Column 6 lines 36-56)

Regarding claim 8, Paranjpe et al. teach that the long throw distance is additionally a function of the number of target sources because a maximum incident angle is required. (Column 6 lines 36-56)

The differences between Paranjpe and the present claims is that the pulsed DC magnetron preventing target poisoning is not discussed (Claim 1), means for providing a reactant gas at the target source is not discussed (Claim 1) and means for providing the reactant gas additionally to the inert gas at the target source is not discussed (Claim 2).

Regarding the pulsed DC magnetron preventing target poisoning (Claim 1), Sellers teach that dc pulsed sputtering prevents target poisoning. (Column 4 lines 23-32)

The motivation for providing a DC pulsed power source is that it allows for preventing target poisoning. (Column 4 lines 30-32)

Regarding the means for providing a reactant gas at the target source (Claims 1, 2), Xiong teach a conduit 40 for providing both an inert gas and a reactive gas. ***The proximity to the target surface results in the reactive species forming ions***, radicals, and atomic components. (Column 3 lines 22-36) Accordingly, in accordance with ***basic, well-known operation of a reactive sputtering process***, reactive gas and non-reactive gases flow into the chamber and power supplied to the cathode provides an electric potential between the cathode and the anode, thus generating a plasma/glow discharge in the chamber, ***the plasma including various species resulting from the reactive gas (referred to herein as "reactive species", e.g., for oxygen, these reactive species may include oxygen ions***, oxygen radicals, atomic oxygen) as well as various species resulting from the non-reactive gas (referred to herein as "non-reactive species"; e.g., for the inert gas Ar, there non-reactive species may include argon ions and radicals). ***Species (ions) bombarding the target release target atoms by momentum transfer*** (hence the typically more massive non-reactive sputtering species being more effective in yielding sputtered target atoms), and the released target atoms react with the reactive species in the plasma to produce a compound (e.g. metal oxide) that become deposited on the substrate (and other surfaces). (Column 3 lines 59-68; Column 4 lines 1-10) A pulsed DC source can be applied to the target. (Column 4 lines 23-25)

The motivation for providing a means for providing a reactive gas and inert gas at the target is that it allows production of dielectric coatings. (Column 2 lines 1-12)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Paranjpe by utilizing DC pulsed sputtering as taught by Sellers and providing a means to provide reactant gas and additionally providing an inert gas at the target as taught by Xiong et al. because it allows for preventing target poisoning and for producing dielectric coatings.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Paranjpe et al. in view of Sellers and Xiong et al. as applied to claims 1, 2, 4, 7 and 8 above, and further in view of Akira (Japan 10-079358).

The difference not yet discussed is where the pressure is below 1 mTorr.

Paranjpe et al. already establish sputtering at 2 mTorr or below. (See Paranjpe discussed above) Akira et al. show that reactive sputtering of TiN during long throw sputtering should take place below 1.0 mTorr. (See Abstract) More particularly at 0.3 mTorr. (See Machine translation paragraph 0030)

The motivation for utilizing pressures below 1.0 mTorr is that it allows for forming films with excellent step coverage. (See Abstract)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have sputtered below 1.0 mTorr as taught by Akira because it allows for forming films with excellent step coverage.

Claims 5, 6, 9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paranjpe et al. in view of Sellers and Xiong et al. as applied to claims 1, 2, 4, 7 and 8 above, and further in view of Scobey (U.S. Pat. 5,525,199).

The differences not yet discussed is where the target source is smaller than the width/area of the substrate to be coated (Claim 5), where the target source is smaller than the width/area of the substrate to be coated by at least a factor of three (Claim 6), utilizing a plurality of sources with reactive gas wherein each additional target source reduces the partial pressure of the reactant gas of every target source without a corresponding reduction in the impingement ratio due to the increase in the total ionization provided thereby is not discussed (Claim 9) and utilizing a plurality of sources with inert gas and reactive gas wherein each additional target source reduces the partial pressure of the reactant gas of every target source without a corresponding reduction in the impingement ratio due to the increase in the total ionization provided thereby is not discussed (Claim 11).

Regarding claim 5, Scobey et al. teach in long throw sputtering utilizing a target source that is smaller than the are of the substrate to be coated. (Column 5 lines 62-64; Column 6 lines 15-17)

Regarding claim 6, Scobey et al. teach that in long throw sputtering the target source can be at least a factor of three times smaller than the substrate area. (Column 5 lines 62-64; Column 6 lines 15-17)

Regarding utilizing a plurality of sources with reactive gas wherein each additional target source reduces the partial pressure of the reactant gas of every target source without a corresponding reduction in the impingement ratio due to the increase in the total ionization provide thereby of claim 9, Scobey et al. teach utilizing multiple source for long throw sputtering. (See Figure 5) Sellers discussed above teach utilizing

reactive gas at the target surface. (See Sellers discussed above) As to the result of using multiple sources with reactive gas since Sellers combined with Scobey et al. teach the apparatus limitations the process result would be achieved. (i.e. the ratio).

Regarding utilizing a plurality of sources with inert gas and reactive gas wherein each additional target source reduces the partial pressure of the reactant gas of every target source without a corresponding reduction in the impingement ratio due to the increase in the total ionization provided thereby of claim 11, Scobey et al. teach utilizing multiple source for long throw sputtering. (See Figure 5) Sellers discussed above teach utilizing reactive gas at the target surface and inert gas at the target surface. (See Sellers discussed above) As to the result of using multiple sources with reactive gas since Sellers combined with Scobey et al. teach the apparatus limitations the process result would be achieved. (i.e. the ratio).

The motivation for utilizing the features of Scobey et al. is that it allows for producing optical films with high packing densities. (See Abstract)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the features of Scobey et al. because it allows for producing optical films with high packing densities.

Claims 13, 14, 16-21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paranjpe et al. (U.S. Pat. 6,572,744) in view of Sellers (U.S. Pat. 5,810,982), Xiong et al. (U.S. Pat. 6,537,428) and Scobey (U.S. Pat. 5,525,199).

Regarding claim 13, Paranjpe et al. teach an apparatus and process for a reactive magnetron sputtering including a vacuum chamber for low pressure sputtering.

At least a pulsed DC power source applying a power to a target that is sputtered. An inert has and a reactive gas can be submitted to the chamber. To improve the quality of the thin film the target should be located at a great distance from the substrate which is known as a long-throw sputtering. (Column 1 lines 15-35, lines 47-50; Column 4 lines 65-68) The pressure can be 2 mTorr or below thus meeting the mean free path requirement. (Column 6 lines 43-56; Column 6 lines 63-66)

Regarding claim 16, Paranjpe et al. teach that the long throw distance can be greater than about 15 inches (i.e. 15 inches to 18 inches). (Column 6 line 49)

Regarding claim 19, Paranjpe et al. the long throw distance is a function of the width/area of the substrate to be coated because it requires the incident angle to be 30 degrees. (Column 6 lines 36-56)

Regarding claim 20, Paranjpe et al. teach that the long throw distance is additionally a function of the number of target sources because a maximum incident angle is required. (Column 6 lines 36-56)

The differences between Paranjpe and the present claims is that the pulsed DC magnetron preventing target poisoning is not discussed (Claim 13), means for providing a reactant gas at the target source is not discussed (Claim 13), coating large scale optics (Claim 13), where a reactant gas is provided in addition to an inert gas at the target source. (Claim 14), the target source is smaller than the width/area of the substrate to be coated (Claim 17), where the target source is smaller than the width/area of the substrate to be coated by at least a factor of three (Claim 18), utilizing a plurality of sources with reactive gas wherein each additional target source reduces

the partial pressure of the reactant gas of every target source without a corresponding reduction in the impingement ratio due to the increase in the total ionization provided thereby is not discussed (Claim 21) and utilizing a plurality of sources with inert gas and reactive gas wherein each additional target source reduces the partial pressure of the reactant gas of every target source without a corresponding reduction in the impingement ratio due to the increase in the total ionization provided thereby is not discussed (Claim 23).

Regarding the pulsed DC magnetron preventing target poisoning (Claim 13), Sellers teach that dc pulsed sputtering prevents target poisoning. (Column 4 lines 23-32)

The motivation for providing a DC pulsed power source is that it allows for preventing target poisoning. (Column 4 lines 30-32)

Regarding the means for providing a reactant gas and inert gas at the target source (Claims 13, 14), Xiong teach a conduit 40 for providing both an inert gas and a reactive gas. ***The proximity to the target surface results in the reactive species forming ions***, radicals, and atomic components. (Column 3 lines 22-36) Accordingly, in accordance with ***basic, well-known operation of a reactive sputtering process***, reactive gas and non-reactive gases flow into the chamber and power supplied to the cathode provides an electric potential between the cathode and the anode, thus generating a plasma/glow discharge in the chamber, ***the plasma including various species resulting from the reactive gas (referred to herein as "reactive species", e.g., for oxygen, these reactive species may include oxygen ions***, oxygen radicals,

atomic oxygen) as well as various species resulting from the non-reactive gas (referred to herein as "non-reactive species"; e.g., for the inert gas Ar, there non-reactive species may include argon ions and radicals). ***Species (ions) bombarding the target release target atoms by momentum transfer*** (hence the typically more massive non-reactive sputtering species being more effective in yielding sputtered target atoms), and the released target atoms react with the reactive species in the plasma to produce a compound (e.g. metal oxide) that become deposited on the substrate (and other surfaces). (Column 3 lines 59-68; Column 4 lines 1-10) A pulsed DC source can be applied to the target. (Column 4 lines 23-25)

The motivation for providing a means for providing a reactive gas and inert gas at the target is that it allows production of dielectric coatings. (Column 2 lines 1-12)

Regarding the coating of large scale optics (Claim 13), Scobey et al. teach coating large scale optics. (See Abstract)

Regarding claim 17, Scobey et al. teach in long throw sputtering utilizing a target source that is smaller than the area of the substrate to be coated. (Column 5 lines 62-64; Column 6 lines 15-17)

Regarding claim 18, Scobey et al. teach that in long throw sputtering the target source can be at least a factor of three times smaller than the substrate area. (Column 5 lines 62-64; Column 6 lines 15-17)

Regarding utilizing a plurality of sources with reactive gas wherein each additional target source reduces the partial pressure of the reactant gas of every target source without a corresponding reduction in the impingement ratio due to the increase

in the total ionization provide thereby of claim 21, Scobey et al. teach utilizing multiple source for long throw sputtering. (See Figure 5) Sellers discussed above teach utilizing reactive gas at the target surface. (See Sellers discussed above) As to the result of using multiple sources with reactive gas since Sellers combined with Scobey et al. teach the apparatus limitations the process result would be achieved. (i.e. the ratio).

Regarding utilizing a plurality of sources with inert gas and reactive gas wherein each additional target source reduces the partial pressure of the reactant gas of every target source without a corresponding reduction in the impingement ratio due to the increase in the total ionization provided thereby of claim 23, Scobey et al. teach utilizing multiple source for long throw sputtering. (See Figure 5) Sellers discussed above teach utilizing reactive gas at the target surface and inert gas at the target surface. (See Sellers discussed above) As to the result of using multiple sources with reactive gas since Sellers combined with Scobey et al. teach the apparatus limitations the process result would be achieved. (i.e. the ratio).

The motivation for utilizing the features of Scobey et al. is that it allows for producing optical films with high packing densities. (See Abstract)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Paranjpe et al. by utilizing the features of Sellers, the features of Xiong et al. and the features of Scobey et al. because it allows for preventing target poisoning during sputtering of dielectric films in order to produce optical films with high packing densities.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Paranjpe et al. in view of Xiong et al. and Sellers as applied to claims 13, 14, 16-22 and 23 above, and further in view of Akira (Japan 10-079358).

The difference not yet discussed is where the pressure is below 1 mTorr.

Paranjpe et al. already establish sputtering at 2 mTorr or below. (See Paranjpe discussed above) Akira et al. show that reactive sputtering of TiN during long throw sputtering should take place below 1.0 mTorr. (See Abstract) More particularly at 0.3 mTorr. (See Machine translation paragraph 0030)

The motivation for utilizing pressures below 1.0 mTorr is that it allows for forming films with excellent step coverage. (See Abstract)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have sputtered below 1.0 mTorr as taught by Akira because it allows for forming films with excellent step coverage.

Response to Arguments

Applicant's arguments filed August 8, 2006 have been fully considered but they are not persuasive.

Applicant has argued that the prior art does not teach that the reactant gas itself is used to impinge the target and thereby produce sputtered target particles. It is argued that Xiong teach that the reactive gas is utilized to impinge the target and produce sputtered target particles. Specifically the reactive gas is ionized to produce ions which bombard the target to produce sputter target through momentum transfer. Xiong state that this is a basic, well-known operation for reactive sputtering. While

Xiong state that the more massive non-reactive species (i.e. ions) are more effective at yielding sputtered target atoms, Xiong does not preclude the reactive species (i.e. ions) from bombarding the target to yield sputter target atoms. In fact Xiong state that ions bombard the target to release target atoms by momentum transfer. Presumably this includes both ionic species of reactive and non-reactive gases. Xiong specifically teach that the reactive gas is introduced at the target and that at such close proximity the reactive gases will produce ions, radicals and atomic components. (See Xiong discussed above)

Applicant has argued that Sellers do not teach the reactive gas impinging the target to thereby produce sputter target particles. It is argued that some of the oxygen would inherently ionize to produce ions which would bombard the target by sputtering. Since Sellers do not explicitly state this Xiong has been added to the main rejection to show such an effect. (See Sellers and Xiong et al. discussed above)

This action will be made NON-FINAL based on the rearrangement of the references and the new cited reasoning in the rejections.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
October 18, 2006